U.S. Environmental Protection Agency
Region IX

Total Maximum Daily Load for Chloride Calleguas Creek Watershed

Approved by: Date:

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Table of Contents

List of Tables:

List of Figures:

SECTION 1: INTRODUCTION

The Calleguas Creek Total Maximum Daily Load (TMDL) for chloride is being established in accordance with Section 303(d) of the Clean Water Act, because the State of California has determined that the water quality standards for the Calleguas Creek watershed and tributaries are exceeded due to chloride. In accordance with Section 303(d), the State of California periodically identifies "those waters within its boundaries for which the effluent limitations … are not stringent enough to implement any water quality standard applicable to such waters." In its 1996 and 1998 303(d) lists, the Los Angeles Regional Water Quality Control Board (Regional Board) identified several segments of the Calleguas Creek Watershed as impaired due to chloride.

In accordance with a consent decree (Heal the Bay, Inc. Santa Monica Baykeeper, Inc. el. al. v. Browner & Marcus, No. 98-4825, March 22, 1999), March 22, 2002 is the deadline for establishment of this TMDL. Because the State will not be able to complete adoption of the Chloride TMDL for the Calleguas Creek by the March 22, 2002 deadline, EPA is establishing this TMDL to fulfill its legal obligations. This TMDL is based largely on the technical efforts produced by the Regional Board staff. EPA anticipates that the State will complete its process and will submit that TMDL to EPA for approval in the near future. At that time, EPA will review the State-submitted TMDL to determine if it meets all TMDL requirements. If EPA approves the State's TMDL, it will supersede this EPA TMDL.

The purpose of a TMDL is to identify the total load of a pollutant which a waterbody can receive without causing exceedances of Water Quality Standards, and to allocate the total load among the sources of the pollutant in the watershed. Although this TMDL does not include an implementation plan, EPA provides general recommendations on implementation measures.

1.1 Watershed Characteristics

The Calleguas Creek watershed area is 343 square miles in Ventura County in an area with a long history of agriculture and recent trends of rapidly growing population. The watershed has three general areas: the northern tributaries, the Arroyo Las Posas/Arroyo Simi system and its tributaries (Reaches 6, 7 and 8); the southern tributaries, Conejo Creek and its tributaries (Reaches 9A, 9B, 10, 11, 12 and 13); and the Calleguas Creek main stem (Reach 3). Revolon Slough and its tributaries (Reaches 4 and 5) drain to the estuary; they are not tributary to Calleguas Creek. [1] This TMDL addresses chloride-related listings along the main stem of Calleguas Creek to the estuary and the listed tributaries. In order to clearly illustrate the tributaries in the Calleguas Creek watershed, EPA uses the following reach definitions, which provide a finer sub-division of the waterbody than is currently defined in the Basin Plan (depicted in Figure 1 and described in Table 1).

[1] Revolon Slough and Beardsley Channel were not listed on the 1998 303(d) list for chloride and are not included in the scope of this TMDL.

Figure 1. Calleguas Creek Watershed with Gauging Stations and Reaches

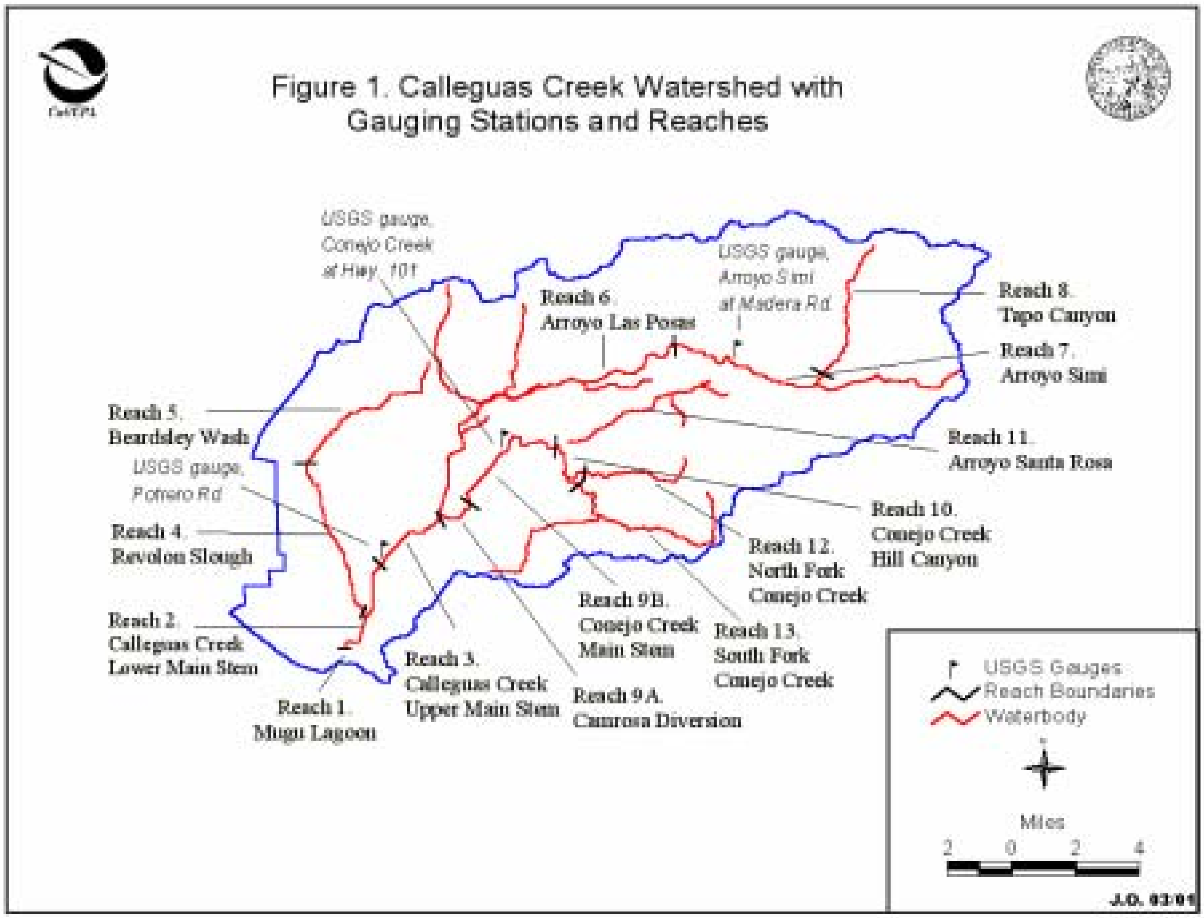

Table 1. Calleguas Creek Watershed Description

Reach No.	Reach Name	Geographic Description	Notes: Hydrology, land uses, etc.
1*	Mugu Lagoon	Lagoon fed by Calleguas Creek	Estuarine; brackish, contiguous with Pacific Ocean
2*	Calleguas Creek South	Downstream (south) of Potrero Road	Tidal influence; impermeable layers; tile drains; Oxnard Plain groundwater basin contains both confined and unconfined aquifers.
3	Calleguas Creek North	Potrero Road upstream to confluence Conejo Creek	No tidal influence. Surface water designated beneficial uses include existing AGR and GWR. Agricultural tile drains present. Camrosa Waste Water Reclamation Facility discharges to percolation ponds and surface water. Pleasant Valley groundwater basin includes confined (impermeable layer) and unconfined perched aquifers. Both are designated as existing AGR.
4*	Revolon Slough	Revolon Slough from confluence with Calleguas Creek Estuary to Central Avenue	Surface water designated beneficial uses include existing AGR and GWR. Agricultural tile drains present. Concrete lined between Central Ave. and Wood Rd; from there the slough is soft-bottomed with rip-rapped sides. Pleasant Valley groundwater basin includes confined (impermeable layer) and unconfined perched aquifers. Both are designated as existing AGR.
5*	Beardsley Wash	Revolon Slough upstream of Central Avenue.	Surface water is not designated for AGR or GWR. This rip-rapped channel drains the hills north from the City of Camarillo to Revolon Slough. Agricultural tile drains present.
6	Arroyo Las Posas	Confluence with Conejo Creek to Hitch Road	Surface water designated as potential AGR and existing GWR. Normally dry at Calleguas confluence except during storm events. Las Posas groundwater basin designated as AGR. Ventura Co. Wastewater Treatment Plant discharges to percolation ponds and surface water at Moorpark, west from Hitch Road. An important avocado growing region.
7	Arroyo Simi	End of Arroyo Las Posas (Hitch Rd) to headwaters in Simi Valley	Surface water designated intermittent GWR, no AGR designation for surface water but flows downstream to Arroyo Las Posas, which has potential AGR and existing GWR. Simi Valley Water Quality Control Facility discharges to surface water. Simi Valley groundwater basin includes both confined and unconfined aquifers. Both are designated as AGR; pumped groundwater and shallow groundwater discharges to surface water. Avocado production present in the lower segments of this reach; tributary to an important avocado growing region.
8	Tapo Canyon	Confluence with Arroyo Simi up Tapo Canyon to headwaters	Surface water designated intermittent GWR in Gillibrand Canyon Creek and potential AGR in Tapo Canyon Creek. Tributary to Arroyo Simi and Arroyo Las Posas, where AGR and GWR are designated.

Reach No.	Reach Name	Geographic Description	Notes: Hydrology, land uses, etc.
			Gillibrand groundwater basin designated as AGR. Tributary to an important avocado growing region.
9A	Conejo Creek	Extends from the confluence with Calleguas Creek to the Camrosa Diversion	Surface water designated as existing AGR and GWR. Camarillo Wastewater Treatment Plant discharges to surface water. Pleasant Valley groundwater basin contains both confined and unconfined perched aquifers. Both are designated as AGR. Limited cultivation of salt-sensitive crops.
9B	Conejo Creek main stem	Extends from Camrosa Diversion to the Confluence with Arroyo Santa Rosa	Surface water designated as existing AGR and GWR. Pleasant Valley groundwater basin contains both confined and unconfined perched aquifers. Both are designated as AGR. Limited cultivation of salt sensitive crops.
10	Hill Canyon reach of Conejo Creek	Confluence with Arroyo Santa Rosa to confluence with N. Fork; and N. Fork to just above Hill Canyon WWTF	Surface water designated as intermittent GWR. This reach receives N. Fork surface water that exceeds the WQO of 150 mg/L. The Hill Canyon Wastewater Treatment Facility discharges upstream of the confluence with N. Fork. Conejo groundwater basin designated as existing AGR. Limited cultivation of salt-sensitive crops.
11	Arroyo Santa Rosa	Just upstream from the confluence with Conejo Creek to headwaters	Surface water designated as intermittent GWR. Olsen Rd. Wastewater Reclamation Plant (WRP) to be decommissioned and influent to be diverted to the Hill Canyon Wastewater Treatment Facility (WWTF). Dry before the confluence with Conejo Creek, except during storm flow. Arroyo Santa Rosa groundwater basin designated as AGR. Limited cultivation of salt-sensitive crops.
12	North Fork Conejo Creek	From just above Hill Canyon WWTF to headwaters of the North Fork	Surface water designated as existing AGR and GWR, but currently exceeds chloride WQO of 150 mg/L. Limited cultivation of salt-sensitive crops.
13	South Fork Conejo Creek	Confluence with N. Fork to headwaters of the South Fork—two channels	Surface water designated as intermittent GWR. Groundwater exceeds chloride WQO of 150 mg/L. Pumped Groundwater discharges to surface water. Limited cultivation of salt-sensitive crops.

*Reaches are not included in this TMDL.

AGR: Agriculture beneficial use. GW: Groundwater. GWR: Groundwater Recharge beneficial uses. WQO: Water Quality Objective. POTW: Publicly Owned Treatment Works (discharger of treated municipal wastewater).

1.2 Information Sources

This TMDL is largely based on the technical efforts produced by the Regional Board staff. The Regional Board staff used available data/information on the Calleguas Creek watershed from a variety of sources in the development of the TMDL. This TMDL further clarifies EPA and Regional Board's position on numerous issues raised by commentors during the public comment period of EPA and Regional Board's December 12, 2001 public review draft.

1.3 Organization

This report is divided into sections. Section 2 (Problem Statement) describes the nature of the environmental problem addressed by the TMDL. Section 3 (Numeric Targets) identifies the numeric target to be used to evaluate whether the Calleguas Creek watershed is attaining water quality standards. Section 4 (Source Analysis) describes what is currently understood about the sources of chloride impairment in the watershed. Section 5 (Linkage Analysis) provides an analysis of the relationship between sources and in-stream water quality impairment. Section 6 (TMDLs and Allocations) identifies the total load of chloride that can be delivered to the Calleguas Creek watershed without causing violation of water quality standards, and describes how the total load will be apportioned. Section 7 (Implementation and Monitoring Recommendations) contains EPA's general recommendations on the implementation and monitoring of this TMDL. Section 8 (Public Participation) describes public participation in the development of the TMDL.

SECTION 2: PROBLEM STATEMENT

This section summarizes how chloride is impairing the beneficial uses of the Calleguas Creek watershed. It includes a description of the water quality objectives, designated beneficial uses, and detailed assessment of the extent of the chloride impairment in the Calleguas Creek watershed.

2.1 Water Quality Standards

In accordance with the Clean Water Act, TMDLs are set at levels necessary to implement the applicable water quality standards. Under the Clean Water Act, water quality standards consist of designated uses, water quality criteria to protect the uses, and an antidegradation policy. The State of California uses slightly different language (i.e., beneficial uses, water quality objectives, and a non-degradation policy). They are defined in the Regional Water Quality Control Plans (Basin Plans). This section describes the State water quality standards applicable to the Calleguas Creek watershed TMDL using the State's terminology. The remainder of the document simply refers to water quality objectives.

2.1.1 Water Quality Objective

The Water Quality Objective (WQO) of 150 mg/L for Calleguas Creek Watershed (above Potrero Road) is defined in the current Los Angeles Regional Board Basin Plan .[2] (Table 3-8, Water Quality Objectives for Selected Constituents in Inland Surface Water). From 1978 through the present, the chloride WQO for Calleguas Creek north from Potrero Road has been established at 150 mg/L. A chloride objective was not established for the Mugu Lagoon and the Calleguas Creek Estuary, due to tidal influences.

The Regional Board staff has prepared a Basin Plan amendment changing the objective to 110 mg/L for some reaches; however, this basin plan amendment had not yet been presented to the Board at the time of the establishment of EPA's TMDL. The draft TMDL (December 12, 2001) was based on the proposed new objective because the Regional Board staff was preparing to submit the revised new objective and the TMDL to the Board as a package. However, as a result of the delay in that process, and in consideration of several public comments questioning the appropriateness of establishing this TMDL based on the 110 mg/L standard, the TMDL has been revised, and this final TMDL is calculated to achieve the existing standard of 150 mg/L.

EPA notes that there were interim limits of 160 and 190 mg/L for chloride in some reaches in the Calleguas Creek from 1997 to March 29, 2002 in accordance with the State of California's Chloride Policy. However, the 1998 303(d) listing was based on the exceedance of the permanent standard of 150 mg/L and this EPA TMDL is based on the permanent standard of 150 mg/L in the current Basin Plan.

2.1.2 Beneficial Uses of the Watershed

Table 2.1 in the Basin Plan for the Los Angeles Region (Regional Board, 1994) lists 14 beneficial uses of surface water for Calleguas Creek. Excerpts from this table are reproduced in Table 2, herein. These uses are specified as existing (E), potential (P) or intermittent (I) uses. All beneficial uses must be protected.

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[2] Los Angeles Regional Board Basin Plan 1994.

Table 2. Beneficial Uses of Inland Surface Waters in Calleguas Creek Watershed, Excerpt from the Basin Plan, Table 2-1.

Reach	Hydro. Unit No.	MUN #	IND	PROC	AGR	GWR	FRSH	NAV	REC 1	REC 2	COM
Calleguas Creek	403.11	P*			E	E	E		E	E	
Calleguas Creek	403.12	P*	E	E	E	E			Eq	E	
Revolon Slough	403.11	P*	P		E	E			Eq	E	
Beardsley Channel	403.61	P*					E		E	E	
Conejo Creek	403.12	P*	E	E	E	E			Eq	E	
Conejo Creek	403.63	P*				I	I		I	I	
Arroyo Conejo	403.64	P*				I	I		I	I	
Arroyo Conejo	403.68	P*				I	I		I	I	
Arroyo Santa Rosa	403.63	P*				I	I		I	I	
Arroyo Santa Rosa	403.65	P*				I	I		I	I	
North Fork Arroyo Conejo	403.64	P *			E	E			E	E	
Arroyo Las Posas	403.12	P*	P	P	P	E			E	E	
Arroyo Las Posas	403.62	P*	P	P	P	E	E		E	E	
Arroyo Simi	403.62	P*	I			I	I		I	I	
Arroyo Simi	403.67	I*	I			I	I		I	I	
Tapo Canyon Creek	403.66	I*		P	P	I			I	I	
Tapo Canyon Creek	403.67	I*		P	P	I			I	I	
Gillibrand Canyon Creek	403.66	P*				I	I		I	I	
Gillibrand Canyon Creek	403.67	P*				I			I	I	

Reach	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET
Calleguas Creek	E	E			E		Ep				E
Calleguas Creek	E				E						
Revolon Slough	E				E						E
Beardsley Channel	E				E						
Conejo Creek	E				E						
Conejo Creek	I				E				E		
Arroyo Conejo	I				E		E				
Arroyo Conejo	I				E						
Arroyo Santa Rosa	I				E						
Arroyo Santa Rosa	I				E						
North Fork Arroyo Conejo	E				E				E		
Arroyo Las Posas	E	P			E						
Arroyo Las Posas	E	P			E						
Arroyo Simi	I				E		E				
Arroyo Simi	I				E						
Tapo Canyon Creek	I				E						
Tapo Canyon Creek	I				E						
Gillibrand Canyon Creek	I				E						
Gillibrand Canyon Creek	I				E						

E: Existing beneficial use. P: Potential beneficial use. I: Intermittent beneficial use. p: Habitat of the Clapper Rail. q: Whenever flows are suitable. * Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date, as cited in the Basin Plan.

#: Pursuant to EPA's decision dated February 15, 2002, EPA notes that the waters identified with an asterisk (*) do not have MUN as designated use until such time as the state undertakes additional study and modifies its Basin Plan (see USEPA Region 9 2002c)

2.2. Impairment of Beneficial Uses

Agricultural Beneficial Use Impairment

The agricultural beneficial use (AGR) is defined in the Basin Plan as "uses of water for farming, horticulture, or ranching including, but not limited to irrigation, stock watering, or support of vegetation for range grazing." For the Calleguas Creek watershed, an existing or potential agricultural supply water beneficial use is listed for Calleguas Creek (Reach 3), Conejo Creek (Reaches 9, 10, and 12), Arroyo Las Posas (Reach 6), and Tapo Canyon (Reach 8), as shown in Tables 1 and 2. In addition, Regional Board staff has observed agricultural beneficial uses in Arroyo Simi (Reach 7) and Santa Rosa (Reach 11).

The quality of the agricultural supply water in the Calleguas Creek watershed has diminished with economic implications for growers, especially in certain areas. Agricultural supply water in Conejo Creek downstream of the confluence of the North and South Forks has increased in chloride concentration. Other users are affected in the Arroyo Las Posas area, where the decline in quality of the shallow aquifers strongly affects a productive agricultural region largely served by the Zone Mutual Water Company (Zone Mutual). Zone Mutual pumps water from 30-foot wells adjacent to the river, drawing from the shallow or perched aquifers.

Groundwater Recharge Beneficial Use Impairment

The GWR beneficial use is defined by the Basin Plan (CRWQCB, 1994) as "uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers." For the Calleguas Creek watershed, an existing, intermittent or potential groundwater recharge beneficial use is listed for all reaches included in this TMDL. In some areas the recharge enters deep aquifers, and in other areas the recharge enters shallow or perched aquifers. Both kinds of aquifers are heavily used in various parts of the watershed.

The deeper aquifers of the North Las Posas, Pleasant Valley, and Oxnard Forebay basins show increasing chloride concentration over recent decades (CRWQCB database, 1957-present). Chloride concentration in some wells, during some periods, routinely exceeds established WQOs for the beneficial use to which the groundwater is applied. For shallow or perched groundwater, this increase may be directly related to an increase in surface water chloride concentrations. Groundwater recharge with higher chloride levels also likely contributes to the increase in chloride levels in deep aquifers. However other factors including concentration of chloride by agricultural irrigation, exacerbated by the overdraft condition of these aquifers, also likely contribute to the continuing decline in the deep aquifer water quality. Those aquifers have been reported to be in overdraft since at least the 1960s (USGS, 1980; Bookman-Edmonston Engineering, Inc., 1998).

In addition to the identified AGR use impairment due to chloride, the Regional Board staff has concluded that the groundwater recharge (GWR) beneficial use also has been impaired in several segments of the watershed. Specifically, the GWR beneficial use is impaired where surface water recharges shallow groundwaters, and those shallow groundwaters are used to irrigate chloride sensitive crops.

2.3 Extent of Impairment

2.3.1. CWA 303(d) Listing Decision

In the State of California's 1996 and 1998 303(d) listing, the following Calleguas Creek waterbody segments were identified as impaired for not meeting the water quality objective of 150 mg/L for chloride.

Table 3. Summary of 303(d) List of Chloride Water Quality Limited Segments in the Calleguas Creek Watershed

WATERBODY NAME/REACH NUMBER	HYDRO UNIT	SIZE (stream miles)
Tapo Canyon /Reach 8	403.67	5.23
Arroyo Simi (Moorpark Fwy (23) to Brea Cyn)/Reach 7	403.62	7.58
Arroyo Las Posas (Fox Barranca to Moorpark Fwy (23)/Reach6	403.62	9.62
Calleguas Creek (Potrero to Somis Rd)/Reach 3	403.12	7.7
Conejo Creek (Santa Rosa Rd to Thousand Oaks City Limit)/Reach 9A	403.63	2.67
Arroyo Las Posas (Lewis Somis Rd to Fox Barranca)/Reach 6	403.12	1.99
Conejo Creek (Above Lynn Rd.)/Reach 9B	403.68	4.98

In order for a waterbody to be considered impaired, the State determined that at least 25% of samples within the data set had to exceed the standard. If at least five data points were found in the 1995 –1998 data set, those data were used in the 1998 303(d) assessment. If less than five data points were found, older data were included in the assessment. The 1998 list also includes listings from 1996, where new data were not assessed in 1998. In 1996, waterbody segments were listed if more than 10% of the samples exceeded the WQO of 150 mg/L.

2.3.2. Surface Water Quality

The Regional Board's review of available surface water data found a substantial increasing trend in chloride concentrations since 1975. Surface water concentration also was higher following the 1989-1991 drought (the average concentration is greater than 220 mg/L in 1992). The Regional Board has also confirmed the data used for the 1998 303(d) listings of waterbodies impaired for chloride. Tables 4 and 5 contain a summary of chloride concentrations in the surface water in the Calleguas Creek based on the available data. A detailed description of the findings is included in the Technical Support Document (USEPARegion 9/Los Angeles Regional Board 2002a).

Table 4: Calleguas Creek Chloride Concentration in Surface Water in 1951-1997 (average concentration)[3]

Waterbody Segment	1951-1974	1975-1986	1987-1997
Calleguas Creek Northern Tributaries (Arroyo Las Posas Reach 6/Arroyo Simi Reach 7)	112 mg/L	109 mg/L	194 mg/L
Calleguas Creek Southern Tributaries (Conejo Creek Reach 9 and its tributaries Reaches 10, 12, 13)	80 mg/L	116 mg/L	179 mg/L

Table 5.Calleguas Creek Characterization Study (CCCS)[4] Chloride Concentration Results, 12 samples once monthly, July 1998 - June 1999.

Reach	CCCS Station Number	Concentration, mg/L		
		Minimum	Average	Maximum
Arroyo Simi, Reach 7	1	51	140	168
Arroyo Las Posas, Reach 6	4	84	150	160
Arroyo Santa Rosa, Reach 11	8	70	110	130
Conejo Creek, confluence North and South Forks, Reach 10	9	94	170	200
Conejo Creek at Hill Canyon, Reach 10	10	100	150	160
Conejo Creek at Camarillo, Reach 9	11	100	140	170

2.3.3. Groundwater Quality

Although groundwater quality was not addressed in the 303(d) listing process, a rudimentary discussion of groundwater quality is useful in order to assess the potential loading to surface water from groundwater discharge, and also to assess the GWR beneficial use.

At present, groundwater discharges from the shallow aquifers to the surface water in the absence of pumping occur in several locations. Areas of significant groundwater discharge include the Simi Valley area, Reach 7; the upper reaches of Conejo Creek, Reaches 12 and 13; the Santa Rosa Valley, portions of Reaches 9 and 11; and in Reach 3, near the confluence with Conejo Creek and near the Camrosa Waste Water Reclamation Facility (WWRF)[5].

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[3] California Regional Water Quality Control Board Los Angeles Region database, 1957-present.

[4] Calleguas Creek Characterization Study: Results of the Coordinated Water Quality Monitoring Program, Surface Water Element. Larry Walker Associates, 2000.

[5] Los Angeles Regional Board Basin Plan 1994, Table 2-2 Beneficial Uses of Ground Waters.

Chloride concentration in groundwater is high enough to impair beneficial uses in some locations, especially in the upstream reaches in the vicinity of the cities of Simi Valley (Reach 7) and Thousand Oaks (Reach 13). The CRWQCB database for groundwater quality shows that concentrations of chloride have generally increased over the period of record. Recent data show a general increasing chloride concentration trend. The increasing concentration in shallow groundwater in unconfined aquifer, due to its close communication with the creek, affects, and is in turn affected by, surface water concentration in the watershed. Other mechanisms include pumping of groundwater for dewatering, hazardous waste site remediation, and irrigation; and natural recharge and discharge, especially from shallow aquifers in particular parts of the watershed.

The chloride concentrations in shallow groundwater are greater than the WQO for all areas except in Reach 11, where the concentration is 130 mg/L, 20 mg/L less than the WQO of 150 mg/L. In Reaches 9 and 12 the concentration is approximately equal to the WQO of 150 mg/L.

Section 3: Numeric Targets

The water quality indicator, or numeric target, is 150 mg/L, as stated in the current Basin Plan. The target of 150 mg/L, applied as an instantaneous maximum, is to protect designated AGR and GWR uses in the watershed. Application of the WQO as an instantaneous maximum is consistent with long standing Regional Board practice.

Table 6. Numeric Targets for Calleguas Creek and Tributaries, by Reach.

Reach Number	Reach Name	Chloride Sensitive Beneficial Uses*	1994 Basin Plan WQO (mg/L)
3	Calleguas Creek North	AGR (E); GWR (E)	150
6	Arroyo Las Posas	AGR (P); GWR (E)	150
7	Arroyo Simi	GWR (I)	150
8	Tapo Canyon	AGR (P); GWR (I)	150
9A	Conejo Creek	AGR (E); GWR (E)	150
9B	Conejo Creek	AGR(E); GWR(E)	150
10	Hill Canyon reach of Conejo Creek	GWR(I); AGR(E)	150
11	Arroyo Santa Rosa	GWR (I)	150
12	North Fork Conejo Creek	AGR(E); GWR(E)	150
13	South Fork Conejo Creek	GWR(I)	150

*Beneficial use designated for this reach in 1994 Basin Plan.

AGR: Agriculture. GWR: Groundwater Recharge. WQO: Water Quality Objective.
E: Existing beneficial use; I: Intermittent beneficial use; P: Potential beneficial use.

Section 4: Source Analysis

The TMDL analysis requires an estimate of loadings from point sources and non-point sources. In the TMDL process waste load allocations are established for point sources and load allocations are established for non-point sources. Point sources typically include discharges for which there is a definite discharge pipe such as wastewater treatment plant discharges, storm water outfalls, and industrial discharges. These discharges are regulated through a permit such as the National Pollution Discharge Elimination System (NPDES) permit or the State's Waste Discharge Requirements (WDRs). Non-point sources by definition include pollutants that originate from diffuse sources.

The following are the types of chloride source loadings to Calleguas Creek and its tributaries (see Table 7 and Figure 2):

- POTWs contribute 21,200 lb/day on an annual average
- Groundwater discharges are 7,310 lb/day on an annual average
- Minor source discharges are 7,200 lb/day on an annual average

In addition, stormwater runoff contributes 35,000 lb/day on an annual average, but it does not contribute to an impairment because during storm flows the chloride is diluted to a concentration less than that which would affect beneficial uses. This chloride TMDL is not in effect during the storm period (see Section 6).

4.1 Point Sources

There are five Public Owned Treatment Works (POTWs) in the watershed. Three of these discharge treated wastewater into the surface waters: Simi Valley Water Quality Control Plant (Reach 7); Hill Canyon Wastewater Treatment Facility (Reach 10); and Camarillo Wastewater Treatment Plant (Reach 9A). The total chloride load from the POTWs to the watershed is about 21,200 lb/day, based on the loads and discharge flows reported under the NPDES permit requirements (details are included in the Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a)). This load does not include loads discharged from the Moorpark (Reach 6) and Camrosa (Reach 3) POTWs. Camrosa Wastewater Treatment Plant and the Moorpark facility discharge treatment municipal wastewater into the shallow aquifer system in Reach 3 and Reach 6, respectively. The chloride loads from these two facilities enter the surface water indirectly via groundwater. Discharges from the five POTWs vary seasonally, but the variation does not appear to be of similar direction or magnitude at all five facilities (see Section 6). A sixth POTW, known at Olsen Road, discharged a small volume as recently as 1999 but has since been decommissioned, and therefore, is not considered in the TMDL.

4.2. Groundwater Discharge

Groundwater, totaling approximately 7,310 lb/day on an annual average, enters the watershed at four general regions (locations) in the form of natural discharges and is considered as a major source. The locations are (1) upper Arroyo Simi, Reaches 7 and 8; (2) the Conejo Creek headwaters (Reaches 12 and 13); (3) the Santa Rosa Valley (Reaches 11 and 9A); (4) the Calleguas Creek main stem (Reach 3). The detailed contribution in each region is described in Table 7 and the Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a).

The sources of the chloride load in the groundwater can be attributed to wastewater discharged through septic systems, groundwater recharge from surface water, and groundwater recharge by irrigation water and/or through precipitation leaching chloride deposited in agricultural fields through irrigation practices. In general, the agricultural irrigation activities in the watershed do not add chloride load to the watershed, instead, they serve to concentrate chlorides already present in irrigation water withdrawn from surface water or groundwater (Detailed discussion is included in the Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a).) The one condition under which agricultural irrigation constitutes a new load is when water is imported to the watershed and applied for irrigation when the imported water contains higher chloride concentration than water within the watershed which would otherwise be applied. This effect is more pronounced during drought years when irrigation water may be imported in substantial quantities, and that imported water is higher in chloride because of the effects of the drought on the supplying aquifers. The load from irrigation is reflected in the linkage analysis in the form of load from groundwater discharge. The load to groundwater is increased during drought conditions by the increased concentration in imported water, and the load from groundwater to surface water increases immediately following drought condition (see Section 5).

4.3 Urban Stormwater Runoff

Urban stormwater is estimated to discharge a total load of 35,000 lb/day of chloride to the watershed. However, the loads occur during storms, when the waterbody is not impaired because of the high flow and greatly increased assimilative capacity. Load from urban runoff is not comparable to other loads which cause the chloride impairment and therefore, is not included in Table 7.

4.4. Minor Sources

Three types of minor sources have been identified in the watershed. They are (1) pumped groundwater for dewatering or aquifer remediation under separate permits at multiple locations; (2) dry weather, non-storm runoff which occurs at many parts of the watershed; and (3) agricultural drainage through tile drains or other conveyances. The details of the loading analysis are provided in the Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a).

Pumping groundwater for remediation of hazardous materials spills is largely concentrated in Reach 13. The current load is about 427 lb/day based on the WDR reports submitted by currently permitted dischargers. Pumping groundwater from the dewatering wells in Reach 7 is permitted under a WDR held by the City of Simi Valley.

Urban non-storm runoff is identified as a flow and load contributor in a number of areas in the watershed with relatively dense urban development, based on findings of a 1987 study in one portion of Reaches 9 and 11 (Boyle Engineering, 1987). A specific non-storm runoff source in the form of dry-season flow has been identified in Tapo Canyon (Reach 8). Possible sources are (1) irrigation water runoff originated from a number of small agricultural nursery operations, and/or (2) large mining operation at the head of the canyon.

Agricultural drainage through tile drains occurs at Reach 3, downstream of the City of Camarillo. The tile drain discharges enter the surface waters directly. Other direct discharges of agricultural runoff have been identified in the watershed, but these are sporadic, dispersed, and irregular. During dry weather agricultural irrigation has a very high percolation rate and, therefore, its direct discharge to the surface water is small in volume and contribute much less load than indirect discharges via groundwater, which are considered elsewhere.

Figure 2: Approximate Locations for Point and Non-point Discharges and Sinks in Calleguas Creek

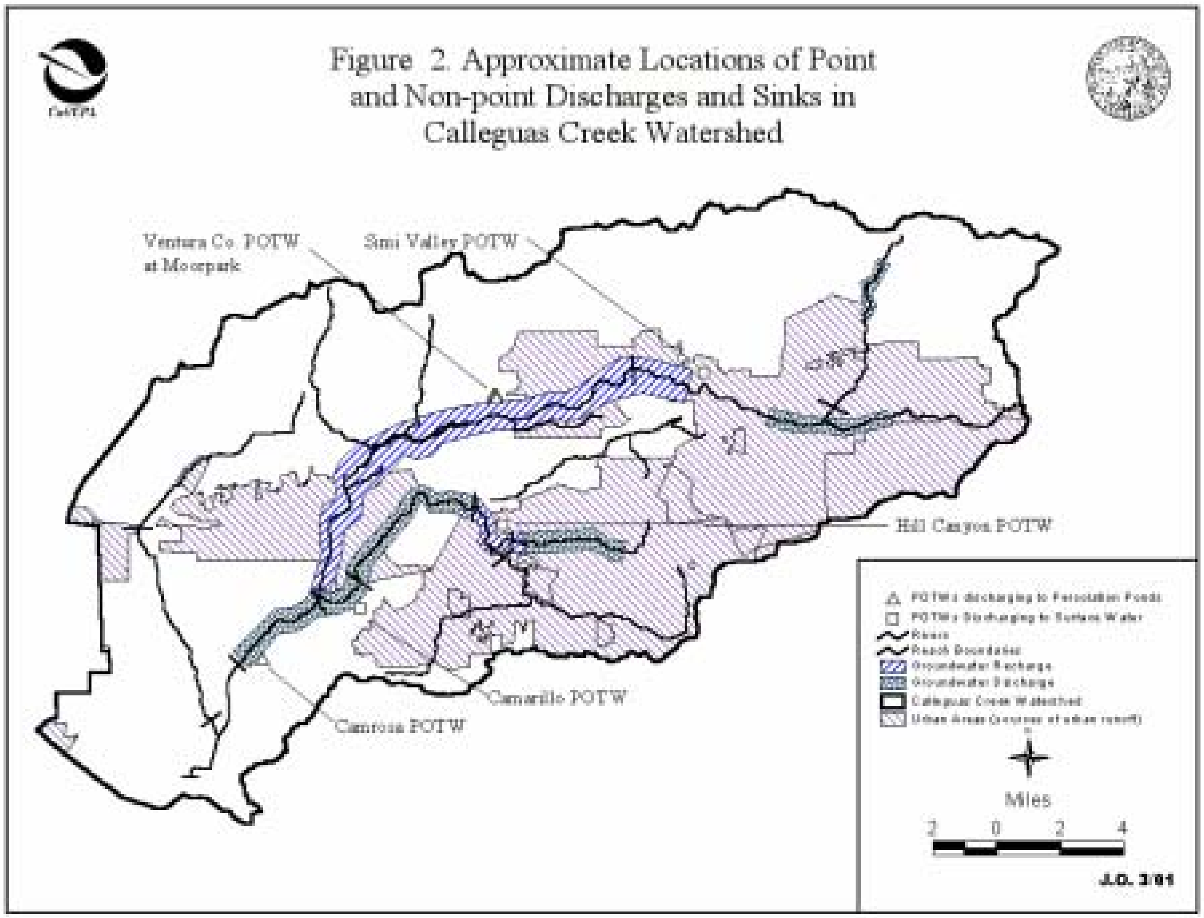

Table 7. Summary of Chloride Loads and Source Activities by Reach (Long Term Annual Average)[#]

Reach	Treated Municipal Wastewater (POTWs)			Groundwater			Miscellaneous Other		
Discharge	**Flow ft^3/s**	**Conc mg/L**	**Mass lb/day**	**Flow ft^3/s**	**Conc mg/L**	**Mass lb/day**	**Flow ft^3/s**	**Conc mg/L**	**Mass lb/day**
Tapo Canyon, Reach 8									
Groundwater discharge				0.5	160	427			
Urban non-storm runoff							0.5	130	347
Arroyo Simi, Reach 7									
Groundwater discharge above USGS gauge station				0.5	160	427			
Urban non-storm runoff							0.5	100	267
Groundwater discharge below USGS gauge station				1	150	801			
Pumped groundwater**							1.5	150	1,202
Simi Valley POTW	14.1	113	8,508						
Arroyo Las Posas, Reach 6									
Moorpark POTW*	3.1	118	1,953*						
Conejo Ck S Fork, Reach 13									
Groundwater discharge				0.5	160	427			
Pumped groundwater**							0.5	160	427
Urban non-storm runoff							1.5	160	1,282
Conejo Ck N. Fork, Reach 12									
Groundwater discharge				1	150	801			
Urban non-storm runoff							1.5	150	1,202
Arroyo Santa Rosa, Reach 11									
Groundwater discharge				0.8	130	555			
Urban non-storm runoff							1	100	534
Conejo Ck Hill Cyn, Reach 10									
Hill Canyon POTW	15.2	118	9,572						
Conejo Creek Main Stem, Reach 9B									
Groundwater discharge				1	150	801			
Urban non-storm runoff							0.5	100	267
Sub-Surface Inflow							0.5	126	337
Conejo Creek Main Stem, Reach 9A									
Groundwater discharge				0.5	150	401			
Camarillo POTW	3.3	175	3,084						
Calleguas Ck, Reach 3									
Groundwater discharge				1	250	1,335			
Agricultural discharge**							1	250	1,335
Camrosa POTW *	2.3	250	3,071*						
Rising groundwater near Camrosa POTW				1	250	1,335			
TOTALS			21,200			7,310			7,200

#: At typical low flow, defined as 50 percentile based on the historical flow (Section 6.1 Flow Condition and Figure 4).
* Discharge to groundwater, therefore load and flow are not included in in-stream totals.
** See discussion under Section 4.3 minor sources.

Section 5. Linkage Analysis

The linkage analysis of a TMDL is intended to characterize the physical relationship between sources of the pollutant and impaired conditions in the watershed. Some chloride sources in the Calleguas Creek watershed originate as point discharges, and others as non-point sources, but all have geographic specificity. Conditions in impaired reaches of the waterbody are functions of a wide variety of factors including (1) timing; (2) magnitude, (3) location of sources, (4) transport and transformation of the pollutant in the stream system, and (5) assimilative capacity for each reach, a function of hydrology and the amount of water present in the reach. Source data provides one part of the TMDL calculation. It is also necessary to determine the assimilative capacity of the receiving water to accommodate chloride loadings. This section describes the use of a mass balance water quality model to relate chloride loadings in the Calleguas Creek to water quality concentrations, its data source and the key assumptions related to the model application.

5.1. Mass Balance Model

For a chemically conservative pollutant such as chloride, the linkage analysis is simplified because it needs to consider only transport, not transformation, of the substance. Therefore the linkage analysis was conducted with a mass-balance model based on spreadsheet-style calculation of inflows and outflows for each reach. The mass balance model uses a plug-flow approach, so it calculates the flow rate and chloride concentration for a reach based on conditions in the reach immediately upstream as well as inputs within the reach itself. Thus, the discharge from an upstream reach to a downstream reach is computed using the equation:

$$Q\ out = Qin_1 + Qin_2 + \ldots + Qin_n - Qwithdrawals$$

(Q out is the out-flow to the downstream reach; Q in is in-flow from the upstream reaches and input from the identified sources within the reach; Withdrawal is the flow taken from the reach including water for agricultural irrigation and groundwater recharge)

The model assumes immediate and complete mixing of all inputs within each reach, and no chemical changes in the constituent of concern within the waterbody. Therefore in-stream chloride concentration is calculated using flow rate and chloride concentration of inflows to the reach, using the equation:

$$C\ out = (Cin_1Qin_1 + Cin_2Qin_2 + \ldots + Cin_nQin_n)/Q_{out}$$

(Cout is the chloride concentration in the outflow; Cin is the chloride concentration in the inflow from the upper reach or identified sources in the reach).

Withdrawals and outflows from each reach are assumed to convey chloride in the same concentration, the concentration produced by mixing within the reach.

The model was used to conduct a linkage analysis, by predicting chloride conditions at various locations in the waterbody under changing conditions. This model was used to calculate the current inputs and outputs of each individual reach, loading capacity and allocations for each reach. This analysis also was used to (1) evaluate whether the reductions required under the TMDLs are achievable; (2) verify that the identified critical conditions do in fact result in the highest modeled concentration; and (3) evaluate whether the water quality objectives will be successfully met under both the current and planned discharges (Camrosa (Reach 9) Diversion which is presently under construction) when the TMDL is implemented.

5.2. Data Sources

Input to the model was based on best available information. The following data sources are included in the Reference Section of the TMDL and detailed in the Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a). A few key data sources used for the model input are:

For surface waters:

- US Geological Survey flow data from 1979 through 1983 at the gauge locations at Arroyo Simi at Madera Road, Conejo Creek above Highway 101 and Calleguas Creek at Potrero Rd.;
- Calleguas Creek Characterization Studies by Larry Walker Associates (2000);
- WDRs from POTWs in the watershed, dischargers of pumped groundwater;
- Stormwater Monitoring Results for Ballona Creek (LA County 2000).

For groundwater:

- Santa Rosa Groundwater Basin Management Plan by City of Thousand Oaks and Camrosa County Water District (1987);
- Las Posas Basin Groundwater Elevations and Water Quality by Calleguas Municipal Water District and United Water Conservation District (1999);
- Annual Groundwater Monitoring Report by Camrosa Water District (1998);
- Report on Arroyo Simi Characterization by Simi Valley County Sanitation District (1995);
- North Las Posas Basin Hydrogeologic Investigation by the Calleguas Municipal Water District and Metropolitan Water District of Southern California (1989).

5.3 Model Assumptions

The model requires information for all inflows and outflows at a number of locations. In several cases where few or no measurements have been made of flow volume or chloride concentration in the waterbody, Regional Board staff made assumptions about flow and chloride load. All assumptions have been made consistent with the best available information, and using Regional Board staff's best professional technical judgment**.** The Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a) describes the model assumptions, the input information about chloride sources and reach interrelationships during critical and non-critical conditions, and the resulting use of the model to predict the impact of specified load allocations for this TMDL in further detail.

There are a few key assumptions used in the application of the mass balance model:

- Inflows from agricultural irrigation return flows are negligible throughout the waterbody. This is predicated on the assumption that farmers apply only the minimum necessary irrigation water for crop productivity, and that all applied water is taken up by crops in the root zone. The cases where this is not true, when water is applied in larger amounts for purposes of leaching or because of overwatering, are sporadic, dispersed, and difficult to quantify; it is assumed the load contributed to the surface water from those discharges is negligible compared to other loads. The chloride contained in the irrigation water is deposited in the root zone when the water is taken up and/or evaporates, and therefore appears in the model in the form of loads in groundwater discharges to the surface water. Irrigation is therefore not treated as a source of flow or chloride load in the model, with the exception of fields drained by tile drains which directly discharge into the surface water;

- The model was developed using data for "typical low flow" conditions, with assumptions about flow volume and chloride concentration documented in Table A-1 of the Technical Support Document. "Typical low flow" is a reasonable assumption for the most usual day-to-day average conditions in the Calleguas Creek, and therefore the condition that may be expected to be described by the bulk of the available data from various sources. Other conditions are modeled using reasonable assumptions about their relationship to the typical low-flow conditions. Those assumptions are documented in Table A-2 of the Technical Support Document;
- Diversions of surface water currently approved for Reach 9B will reduce in-stream flow to 6 ft^3/sec under all conditions except storm flow. In-stream flow of 6 ft^3/sec is the minimum flow required to support habitat in the stream. Because the water rights owners have expressed an intention to sell the diverted water to existing agricultural markets in the vicinity, it is reasonable to assume the water rights owners will divert all surface flow in excess of the minimum in-stream requirement;
- 1999 POTW discharge data are representative of conditions in the near future. This is a reasonable assumption because those are the most recent full year's data available at the time the model was developed.

SECTION 6: TMDLs and ALLOCATIONS

The purpose of this section is to determine the total loading of chloride which the Calleguas Creek watershed can receive without exceeding the water quality objectives, and to apportion the total among the sources of chloride. A TMDL is defined as the sum of the individual waste load allocations for point sources, and load allocations for nonpoint sources and natural background pollutants, such that the loading capacity of the receiving water is not exceeded.

TMDL = Waste Load Allocations (ΣWLAs) + Load Allocations (ΣLAs)

This section uses the results of the linkage analysis above to establish load allocations (LAs) for loads from natural background sources and other nonpoint sources, and waste load allocations (WLAs) for currently permitted point source discharges. Calculated LAs and WLAs use results of the linkage analysis in the previous section, incorporating a margin of safety. LAs and WLAs are established for two conditions, one for routine days, defined as all non-storm, non-drought days. The other set of LAs and WLAs are established for drought/immediately post drought conditions. TMDLs are not in effect during storm periods.

This TMDL is calculated to be 50,000 lb/day for both conditions. The allocations were calculated using the model discussed in Section 5 based on the following steps: (1) determination of the times when the chloride impairment is most severe (critical conditions); (2) determination of the flow condition(s) during critical times based on the historic flow monitoring data; (3) determination of an in-stream concentration target of 136 mg/L based on the WQO of 150 mg/L and an explicit Margin of Safety of approximately 10% to account for the uncertainties in the analysis[6]; and (4) calculation of TMDLs that will achieve the in-stream concentration target of 136 mg/L under the critical conditions using the model discussed in the above Linkage Analysis section. The resulting allocations are set forth in Tables 8, 9 and 10. These allocations, when totaled, constitute the loading capacity or TMDL. These steps are discussed in more detail in the following sections.

6.1. Flow Conditions

In order to understand when the worst case impairment occurs in the watershed, the Regional Board examined the different flow regimes. The Regional Board used the most recent historical flow data (1979-1998) collected at three USGS gauge stations in the Calleguas Creek watershed (Arroyo Simi, Conejo Creek and Potrero Road) (Figure 4: Cumulative frequency distribution of mean daily discharge at three gauging stations) to define the following flow conditions.

- **Non-storm, non-drought period:**
    - consists of three conditions: lowest flow, typical low flow and maximum non-storm flow.

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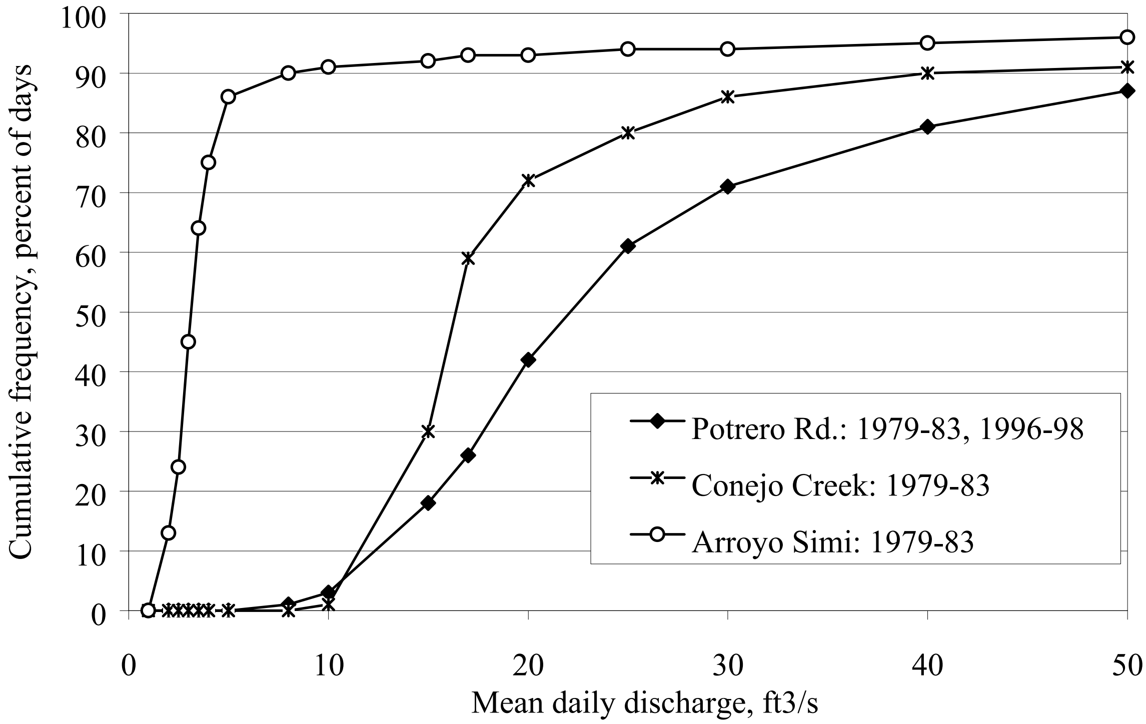
[6] As discussed in Section 3, the numeric target for this TMDL is the WQO of 150 mg/L. The numeric target is the in-stream goal which equates to achievement of the WQO. The concentration target discussed in this section is a different number, which is used to calculate the allocation. It is lower than the numeric target of 150 mg/L because of the application of the margin of safety.

    - Extreme low flow (7Q10 flow) occurs at 0 ft^3/sec at Arroyo Simi, 10 ft^3/sec at Conejo Creek and 12 ft^3/sec at Potrero Road. There is an assumption of zero discharge of any sources other than POTWs at this flow condition;
    - Typical low flow (most usual day-to-day routine condition) occurs 50th percentile (median) of the cumulative frequency in the Figure 4. These flows are at 3.5 ft^3/sec at Arroyo Simi, 16 ft^3/sec at Conejo Creek and 22 ft^3/sec at Potrero Road;
    - Maximum non-storm flow is the maximum surface flow during times not affected by storm discharges. The maximum non-storm flow was the 80th percentile flow for both Conejo Creek and Potrero Road, and the 85th percentile flow for Arroyo Simi. The flows for the gauging stations are 5 ft^3/sec at Arroyo Simi, 20 ft^3/sec at Conejo Creek and 32 ft^3/sec at Potrero Road.
- **Drought Condition**: occurs at the following flows: 2 ft^3/sec at Arroyo Simi, 9 ft^3/sec at Conejo Creek and 15 ft^3/sec at Potrero Road. Natural discharges disappear because the water table has dropped; pumping for dewatering also declines or disappears, because the water table is sufficiently low that nuisance flows do not appear in low-lying parts of the Simi Valley area and construction of the pumping wells does not penetrate to the depth of the lowered water table. Pumping for remediation is assumed to be unchanged. During drought, the water purveyors in the watershed supplement their water supplies by importing water from outside the watershed which is higher in chloride concentration than during non-drought conditions.
- **Immediately post-drought maximum non-storm conditions:** The chloride concentration in groundwater discharges is estimated at 20% greater than the concentration during "typical low flow", because groundwater reservoirs have been subjected to enhanced concentration with reduced dilution because of sparse rainfall. The water purveyors may still be supplying imported water with elevated chloride concentrations, which leads to continued discharge of effluent of domestic water from the POTWs with 20% greater chloride load than during non-drought periods. The worst case conditions occur when, during the post-drought period, the "maximum non-storm condition" occurs and groundwater discharge volume is at its greatest while groundwater concentration remains high because of drought conditions. The flows at the gauging stations are 5 ft3/sec at Arroyo Simi, 20 ft3/sec at Conejo Creek and 32 ft3/sec at Potrero Road.
- **Storm period:** occurs at the following flows: 32 ft3/sec at Arroyo Simi, 60 ft3/sec at Conejo Creek and 140 ft3/sec at Potrero Road. The TMDL is not in effect during storm periods.

Figure 3. Cumulative frequency distribution of mean daily discharge at three gauging stations, recent historical data.



Source: USGS, 2000.

6.2. Seasonal Variation and Critical Condition

TMDLs must take into account critical conditions and seasonal variation (40CFR 130.7(c)(1)).

6.2.1 Seasonal Variation

For many pollutants, the highest concentrations occur during low flow conditions, which usually occurs during the late summer and early fall seasons. As such, the seven-day-ten-year low flow (7Q10) or another low flow measure often is identified as the "critical" condition. However, in Calleguas Creek, the highest chloride concentrations occur during maximum non-storm conditions, and these concentrations are even higher during and shortly after a drought. The Regional Board believes that non-point sources such as natural groundwater discharge and anthropogenic sources such as pumping for groundwater remediation and construction dewatering are responsible for the increased chloride loading under these conditions. Based on Regional Board's analysis, these conditions can occur during any season. Therefore seasonality was not a determining factor in defining the critical condition for this TMDL.

6.2.2 Critical Conditions

Based on Regional Board's analysis, there are two sets of critical conditions considered, which will occur during two flow regimes. For the standard routine conditions (non-storm and non-drought), the maximum non-storm condition represents the standard critical condition. For the drought and immediately post drought conditions, the post-drought maximum non-storm flow is the long term critical condition.

The WLA/LA is defined for routine days using critical conditions because this could occur on any given day, without advance notice. Using critical conditions for every day also contributes to a greater margin of safety, as required in developing TMDLs. The development of critical conditions and data used for that analysis, are described in detail in the Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a).

6.3. Waste Load Allocations and Load Allocations

Tables 8 and 9 summarize the WLAs for major discharges, and aggregated WLAs for minor discharges, and LAs for non-point sources during routine conditions and drought conditions, respectively. Table 10 details the WLAs for individual minor dischargers identified in Reach 13. The allocations are selected such that the modeled in-stream chloride concentration does not exceed the WQOs for any reach of the waterbody during critical conditions, including an explicit margin of safety of approximately 10%.

- **WLAs and LAs under routine conditions (Tables 8 and 10)**. Those conditions are assumed to exist on any day of the year that is not influenced either by storm flow or by drought conditions (defined in Section 6.1above). WLAs and LAs for routine conditions are calculated based on conditions during maximum non-storm flow, as discussed above. This applies to any non-drought day not affected by storm runoff. For minor discharges, including those listed in Table 10 and those not explicitly named but described in aggregate in the table, the WLAs are set such that concentration of the discharges will be equal to the target concentration in the receiving reaches; in all reaches, that concentration is 136 mg/L.

- **WLAs and LAs under drought conditions (Tables 9 and 10)**. The allocations are selected such that the modeled in-stream chloride concentration does not exceed the target concentration of 136 mg/L for any reach of the waterbody during drought conditions. Allocations for the drought condition are more rigorous than those specified for everyday critical conditions, based on the linkage analysis results that show waterbody chloride concentration is substantially greater during drought conditions and in the period immediately following a drought. Drought WLAs/LAs are in effect beginning on June 1 of any year when the previous 12 months' total rainfall is less than 11" and continuing until the first June 1 on which the previous 12 months' total rainfall is equal or greater than 12.2". For minor discharges not explicitly named but described in aggregate in the table, the WLAs are calculated such that concentration of the discharges will be equal to the target concentration in the receiving reaches; in all reaches, that concentration is 136 mg/L. For minor discharges in Reach 13, the WLA is set to reach a discharge concentration of 124 mg/L in order to attain the in-stream target concentration of 136 mg/L.

- **No WLAs or LAs are in effect under storm conditions**.

Table 8 WLAs and LAs under Routine Conditions[#]

Discharge	**WLA (lb/day)**	**LA (lb/day)**
Tapo Canyon, Reach 8		
Groundwater discharge		640
Urban non-storm runoff		500
Arroyo Simi, Reach 7		
Groundwater discharge, headwaters		640
Urban non-storm runoff		400
Pumped groundwater	1,400	
Groundwater discharge, near Simi Valley		1,600
Simi Valley POTW	10,100	
Arroyo Las Posas, Reach 6		
Moorpark POTW	2,200	
Conejo Creek South Fork, Reach 13*		
Groundwater discharge		1,300
Pumped Groundwater	360	
Urban non-storm runoff		2,600
Conejo Creek North Fork, Reach 12		
Groundwater discharge		2,400
Urban non-storm runoff		1,600
Arroyo Santa Rosa, Reach 11		
Groundwater discharge		2,100
Urban non-storm runoff		800
Conejo Creek Hill Canyon, Reach 10		
Hill Canyon POTW	10,100	
Conejo Creek main stem, Reach 9B		
Groundwater discharge		1,400
Sub-Surface inflow		720
Urban non-storm runoff		430
Conejo Creek main stem, below diversion, Reach 9A		
Groundwater discharge		1,600
Camarillo POTW	2,300	
Calleguas Creek Main Stem, Reach 3		

Groundwater discharge near Conejo confluence		1,100
Agricultural discharge		1,300
Camrosa POTW	1,500	
Groundwater discharge near Camrosa POTW		1,500
TMDL	**28,000**	**22,000**

#: routine conditions exist on any day of the year that is not influenced either by storm flow or by drought conditions.

*: see Table 10.

Table 9 WLAs and LAs under Drought Condition#

Discharge	**WLA (lb/day)**	**LA (lb/day)**
Tapo Canyon, Reach 8		
Groundwater discharge		800
Urban non-storm runoff		500
Arroyo Simi, Reach 7		
Groundwater discharge, headwaters		800
Urban non-storm runoff		400
Pumped groundwater	1,200	
Groundwater discharge, near Simi Valley		1,900
Simi Valley POTW	9,200	
Arroyo Las Posas, Reach 6		
Moorpark POTW	1,600	
Conejo Creek South Fork, Reach 13*		
Groundwater discharge		1,500
Pumped Groundwater	330	
Urban non-storm runoff		2,600
Conejo Creek North Fork, Reach 12		
Groundwater discharge		2,880
Urban non-storm runoff		1,600
Arroyo Santa Rosa, Reach 11		
Groundwater discharge		2,500
Urban non-storm runoff		800
Conejo Creek Hill Canyon, Reach 10		
Hill Canyon POTW	9,700	
Conejo Creek main stem, Reach 9B		
Groundwater discharge		1,700
Sub-Surface inflow		730
Urban non-storm runoff		430
Conejo Creek main stem, below diversion, Reach 9A		
Groundwater discharge		1,400
Camarillo POTW	2,200	
Calleguas Creek Main Stem, Reach 3		
Groundwater discharge near Conejo confluence		1,000
Agricultural discharge		1,300
Camrosa POTW	1,500	
Groundwater discharge near Camrosa POTW		1,500
TMDL	**26,000**	**24,000**

#: Drought condition applies during drought and immediately after the drought. Conditions are defined in the above text.

*: see Table 10.

Table 10. WLAs for Pumped Groundwater Discharges in Reach 13*

Discharger	Flow, ft^3/s	Load, lb/day* for Routine condition	Load, lb/day* for Drought Condition
Northrop	0.017	12	11
Rockwell (Tonexant)	0.033	24	22
Teleflex	0.15	110	100
Al-sal	0.056	41	37
Chevron	0.067	49	45
Chevron	0.067	49	45
Emery	0.00046	0.33	0.30
ARCO	0.017	12	11
Mobil	0.017	12	11
Mobil	0.067	49	45
Total Loading		**360**	**330**

* Flow information based on current NPDES permit.

6.4 Margin of Safety

The margin of safety is included to account for uncertainties concerning the relationship between pollutant loads and in-stream water quality and other uncertainties in the analysis. The margin of safety can be incorporated into conservative assumptions used to develop the TMDL, and/or added as an explicit separate component of the TMDL. A number of measured and estimated parameters in this TMDL have some degree of uncertainty (detailed in the Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a)), therefore, the WLAs and LAs proposed in this section incorporate both an implicit and an explicit margin of safety.

- **Implicit margin of safety:** The implicit margin of safety is applied by calculating LAs and WLAs for all days using the critical conditions. That maximum non-storm flow may occur in any season and under circumstances that cannot be reliably forecast, so the LAs and WLAs need to be set at a level that can accommodate those conditions if they should occur. This assumption produces a margin of safety because the critical conditions do not in fact occur on every day not affected by storm runoff, so on most days of a given year the LAs and WLAs are conservative. As shown in Figure 3 and described in the flow condition section above, maximum flow non-storm days constitute the critical condition with the worst case conditions occurring after a drought. Use of the critical conditions as an implicit margin of safety is reasonable because the waterbody's assimilative capacity for chloride is so strongly dependent on in-stream flow, which varies both for reasons that have been documented (such as seasonal and precipitation events) and for other reasons less well understood. For example, because droughts are produced by long-term rainfall and runoff patterns, and vary in duration, runoff volume, and conditions of flow and chloride load, each drought period is likely to produce unique conditions, and data are not available in sufficient detail, for sufficient periods of time, to create a historical statistical model that would predict future conditions. Estimation based on best professional judgment which invariably includes uncertainties were used for the model input (see Section 5.3, Model Assumptions).

- **Explicit margin of safety:** The explicit margin of safety is applied by using the model to compute LAs and WLAs that would reach a target in-stream chloride concentration that is approximately 10% less than the WQO of 150 mg/L for each reach. Setting WLAs using a target concentration of 136 mg/L (10% less than the WQO) reserves a certain portion of the stream's assimilative capacity to accommodate the uncertain loads. Applying an explicit margin of safety in addition to the implicit margin of safety is reasonable because many of the chloride loads in the watershed are not precisely quantifiable with the available data, and the linkage analysis has been completed using estimates of unknown precision. A number of uncertain estimates are accommodated by the explicit margin of safety. In particular, the estimated existing loads from groundwater and other non-point sources are uncertain due to the small number of historical sampling occurrences.

6.5 Verification Modeling

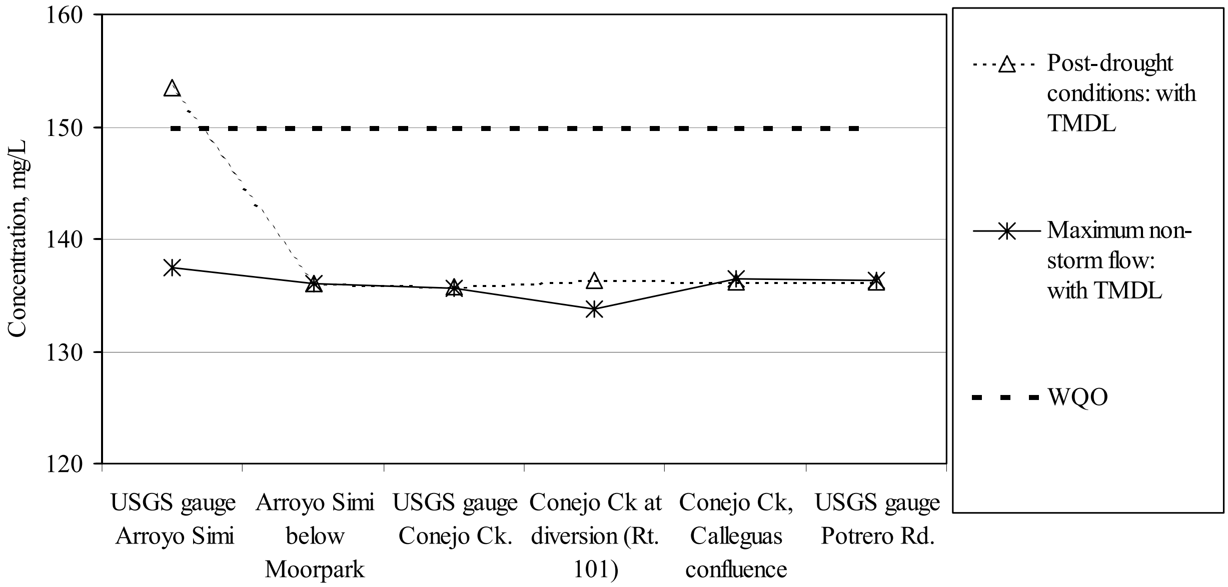
Modeling results (Figure 3) and tables in Appendix in Technical Support Document (USEPA Region 9/Los Angeles Regional Board 2002a)) indicate the expected results when the allocations are implemented. In determining whether the standard of 150 mg/L is being met, we recommend monitoring at the following six monitoring points:

1. USGS gauge at Arroyo Simi in Reach 7;
2. Outflow from Reach 7 into Reach 6, downstream from Simi Valley POTW (Arroyo Simi Below Moorpark);
3. USGS gauge at Conejo Creek in Reach 9B, downstream from Hill Canyon POTW;
4. Outflow from Reach 9A into Reach 9B, where a diversion is planned for agricultural supply water (Conejo Creek at diversion Rt. 101);
5. Confluence of Conejo Creek and Calleguas Creek, downstream from Camarillo POTW;
6. USGS gauge at Portrero Road in Reach 3.

These points are chosen because they are either existing USGS stations where there are available daily flow measurements since 1968, or they are located at the confluence of several tributaries.

To verify that this TMDL, when implemented, will achieve water quality standards, the above locations were modeled for both the drought/post-drought critical condition and the routine critical condition. Figure 3 depicts the predicted in-stream chloride concentration after TMDL implementation.

Figure 4. Predicted In-Stream Chloride Concentration After TMDL Implementation, using Linkage Model (with Reach 9B Diversion)@.



@The modeling suggests that the chloride concentration at the first monitoring point (Reach 7 Arroyo Simi-USGS gauge) may slightly exceed the 150 mg/L standard during the drought/post-drought condition (predicted concentration of 154 mg/L). We note that this monitoring point is not in an area designated for AGR use, and that in the area downstream where AGR is in fact designated as a potential use, the modeled results indicate that concentrations will be well below the 150 mg/L standard, as evidenced by the results for the second monitoring point (Arroyo Simi below Moorpark, near confluence of Reaches 7 and 6). Given the closeness of the modeled number to the water quality objective, the clear results indicating that the objective will be met at all the other monitoring points (and at all six points under the routine critical condition), and the absence of the AGR use in Reach 7, we would conclude that, in our best professional judgment, it is reasonable to assume that implementation of this TMDL should result in meeting the water quality objective at the watershed level and that, at this time, it is not necessary to recalculate the allocations at lower levels.

SECTION 7: IMPLEMENTATION AND MONITORING RECOMMENDATIONS

The main responsibility for water quality management and monitoring resides with the State. EPA fully expects the State to develop and submit implementation measures to EPA as part of revisions to the State water quality management plan, as provided by EPA regulations at 40 C.F.R. Sec. 130.6.

7.1 Implementation Recommendation

The State implementation measures should contain provisions for ensuring that the waste load and load allocations (see Chapter 6) in the TMDL will in fact be achieved. These provisions may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs.

In general, EPA recommends that the State implementation and monitoring plans be designed to determine if, in fact, the TMDL is successful in attaining water quality standards. For this TMDL, EPA recommends that the State consider a holistic approach which consists of a wide range of short-term and long-term of options. They may include source reduction measures, a careful evaluation of the existing water quality objectives, upgrading existing treatment facilities, improvement of existing agricultural practices and septic systems management, and implementing a solution on a watershed or regional scale. EPA expects that the Regional Board will continue to work with the stakeholders to identify the most effective implementation mechanisms and associated implementation schedule.

7.2 Monitoring Recommendation

As recommended in the December 12, 2001 draft TMDL, discharge monitoring as specified in the NPDES permits will be used to evaluate compliance with the WLAs. Ambient monitoring performed as part of the State-wide Ambient Monitoring Program (SWAMP), in conjunction with monitoring performed by local stakeholders, will be used to evaluate the effectiveness of the TMDL.

Stakeholders will be encouraged to monitor in-stream conditions after WLAs are implemented to verify the waterbody meets the specified WQOs. Monitoring should be sufficiently comprehensive to determine whether the identified critical conditions represent all critical conditions. The monitoring might identify whether chloride concentration exceeds WQOs routinely under any identifiable conditions, such as seasonal variations in flow or changes in chloride entering the surface water over the longer term. If additional critical conditions are identified, this TMDL should be revised to protect beneficial uses under those conditions.

SECTION 8: PUBLIC PARTICIPATION

The State and EPA have provided for public participation through several mechanisms. The Regional Board has conducted several public workshops and numerous workgroup meetings during the draft of this TMDL. The Regional Board also held meetings with representatives of a number of stakeholder groups, including the Calleguas Creek Water Resources/Water Quality Subcommittee, Chloride Policy Workgroup, Calleguas Creek Chloride TMDL Elements Workgroup, City of Simi Valley, City of Thousand Oaks, Camrosa Water District, Camarillo Sanitation District, Ventura County Waterworks, District No.1, Calleguas Municipal Water District, Southern California Association of Governments, and Ventura County Farm Bureau. The Regional Board and EPA jointly noticed this TMDL by sending the TMDL to all stakeholders on the Regional Board mailing list as well as by placing a notice in the Ventura County Star on December 19, 2001, in which EPA and the Regional Board solicited public comments during the comment period December 19, 2001 through February 11, 2002. EPA and the Regional Board have carefully considered all comments on this TMDL received by the EPA and the Regional Board through the close of the comment period of February 11, 2002 (EPA Region 9, 2002b).

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